Aquasift Technical Specifications

The Aquasift is powered directly from a computer or cell phone USB port. It has an on-board voltage regulator that converts 5 volt USB power to to 3.3 volts. The microcontroller for the device is an Atmel AtMega328. All communications are handled serially with the device through the USB serial port. The default baud rate is 230400 bps.

The Aquasift is designed to be as versatile as possible when it comes to communications. There are three communication modes: MATLAB, ASCII and binary. In MATLAB mode, the output can be captured with a terminal program and is formatted as a MATLAB script. The script can then be run using MATLAB or MATLAB clone to see graphical data. In ASCII mode, the output is in a text format but there is no MATLAB wrapper. Binary mode is the most versatile and is what is used to interface with the Aquasift software.

The Aquasift firmware directly supports three types of testing modes: Linear sweep, cyclic and square wave voltammetry tests. The firmware also contains an arbitrary waveform generator that extends the Aquasift's functionality to any number of tests that can be controlled and interpreted via the Aquasift software.

The Aquasift supports deposition times from 0 to over 4 billion milliseconds. Quiet times of the same time lengths are also supported by the firmware.

The Aquasift relies on a 1KHz hardware timer to produce all the input and output signals. An anti-aliasing filter limits the frequency generation of the device to 200Hz. The firmware also supports optional digital low pass filters with cutoff frequencies ranging from 1Hz to 200Hz.

Six gain settings are supported for the Aquasift transimpedance amplifier (TIA). The gain settings allow current ranges as small as +/-16uA and as large as +/-16mA. The TIA by default supports a 3-electrode configuration but can be configured for a 2-electrode configuration.

External 12-bit digital-to-analog (DAC) and analog-to-digital (ADC) converters are used with the Aquasift. Having the converters external from the microcontroller allows for greater precision and reduced noise data captures.

There are three types of connectors for electrodes with the Aquasift device: compression, banana jack and terminal block connectors. The compression electrode connector is comprised of a spring-loaded lever that presses a printed electrode against three copper leads. The copper leads have a pitch of 2.5mm and is compatible with commonly manufactured printed electrodes. The banana jack connectors allow standard test leads to be connected directly to the device. The terminal block connector is not populated by defaults but can accommodate a standard screw terminal connector with a .2-inch pitch. This connector allows users to attach any number of electrode interfaces to the device.

There is a flat flexible cable (FFC) connector in the digital section of the device that allows for future expansion of the Aquasift. It contains the SPI and I2C communication lines along with a PWM output and two GPIOs. This allows for future support of additional hardware such as magnetic stirrers and multiplexors.

Even in the prototyping stage, the Aquasift costs less than $100 dollars per device with the majority of the cost being the circuit board. Mass production should allow the Aquasift to be manufactured for $20 or less.

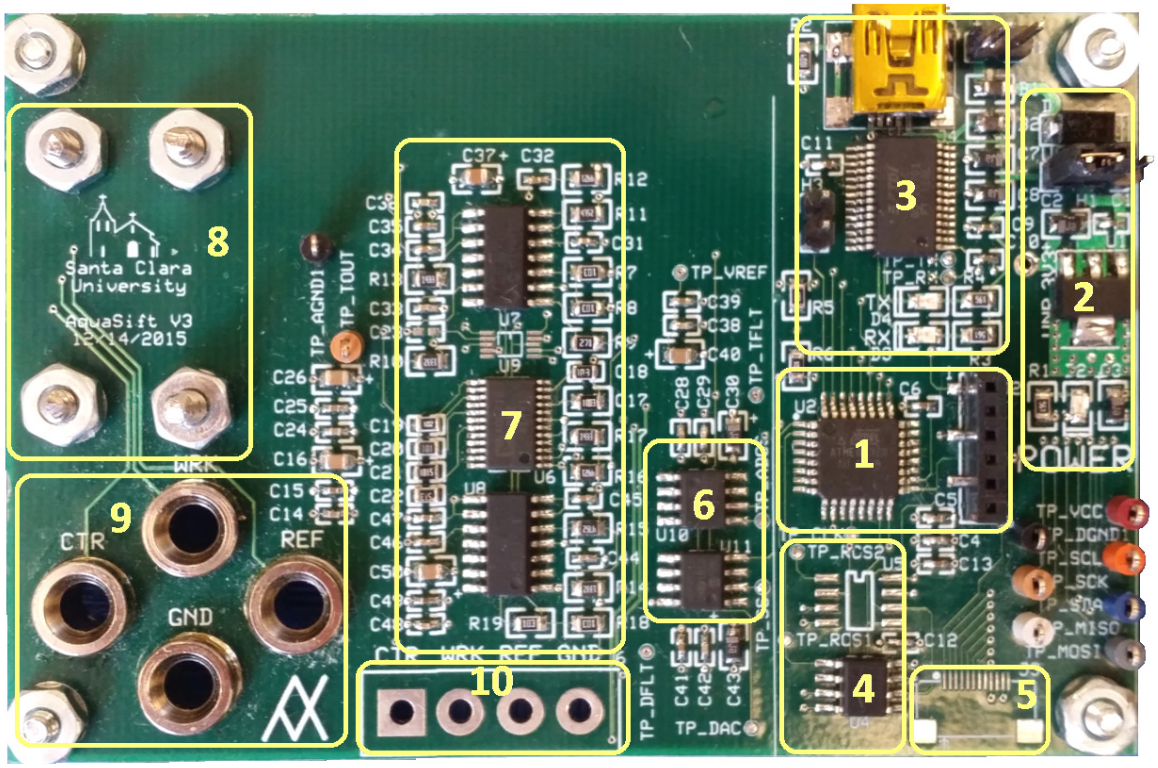

Figure 1: Aquasift Circuit Board Layout

1) AtMega328 microcontroller and JTAG programming port

2) 3.3 volt LDO voltage regulator

3) FTDI USB to serial converter

4) External flash RAM used by the arbitrary waveform generator

5) Optional FFC connector for future hardware expansion

6) External 12-bit DAC and ADC

7) Analog circuitry (TIA and low-pass filters)

8) Compression connector (on bottom side of the board)

9) Banana jack connectors

10) Terminal block connector